existence of the extremely high temperatures was verified by measurements of Brian O'Brien.(32)

(32) Hirschfelder and Magee, B-Division Report

In Figure 7 the illumination as a function of time (according to the theory discussed in footnote 30) is presented. The ordinate is distance squared times "suns", where the "sun" (☉) is a unit of illumination rather than brightness. The temperatures of the radiating surface are indicated along on the curve. This curve is careful for calculating radiation intensities at all distances and times, in-so-far as atmospheric absorption can be neglected.

6.4-3 Incendiary Effects

Measurements on the incendiary effects were made at Trinity by Marley and Reines.(33) They found that no fires were started in wooden materials which

(33) Marley and Reines, LA 364

were appreciably outside the fire zone, but that charring occurred to beyond 1000 yards. Fir timber was slightly scorched out to distances of 2000 yards.

In an attempt to understand scorching and charring, let us consider a constant source of heat on a surface. It can be shown rather easily that the surface temperature is raised after a titime by the amount:

$$T_s = \frac{2}{\sqrt{\pi}} \frac{Q}{K\rho C} \sqrt{t}$$

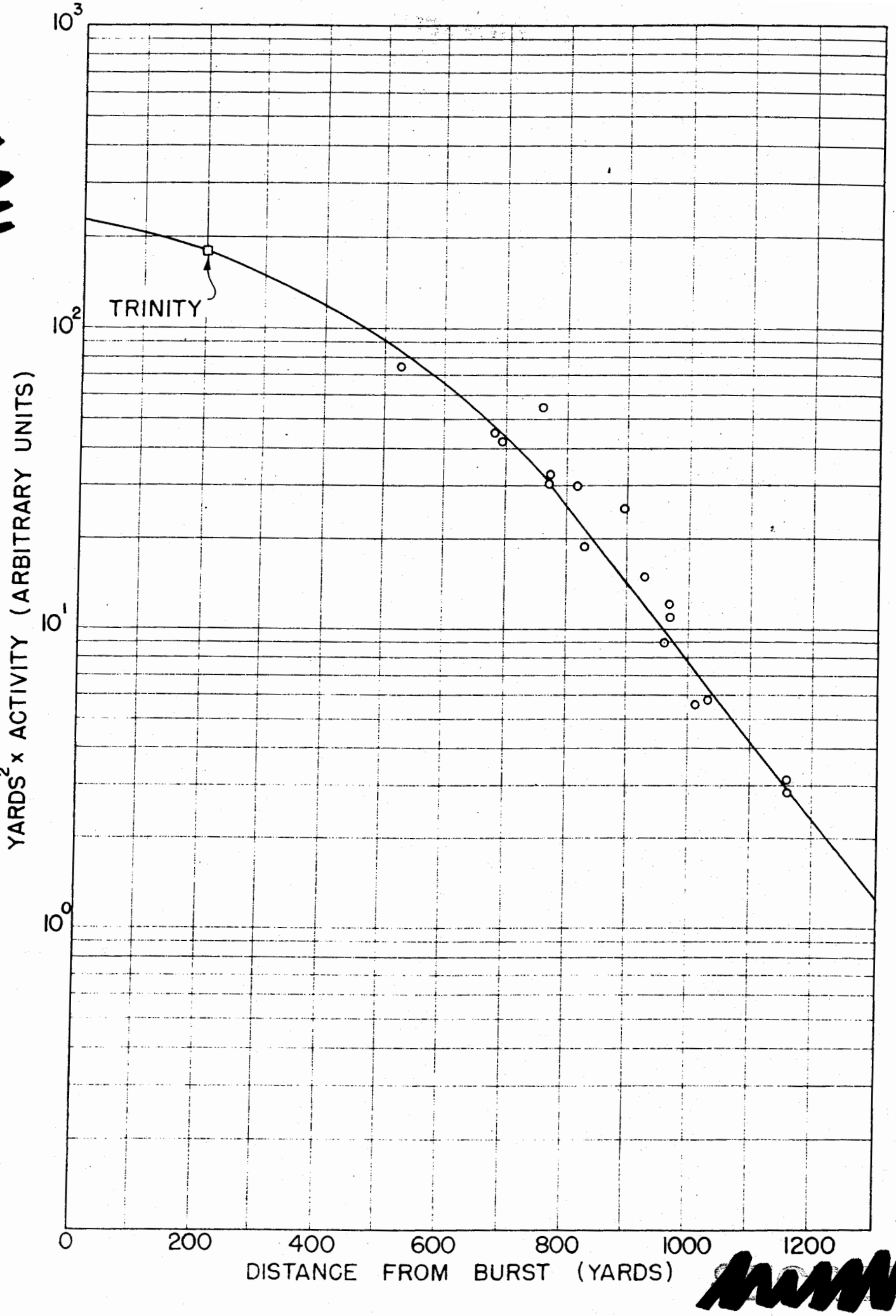
Where: Q = Strength of heat source (cal/cm^2 sec)

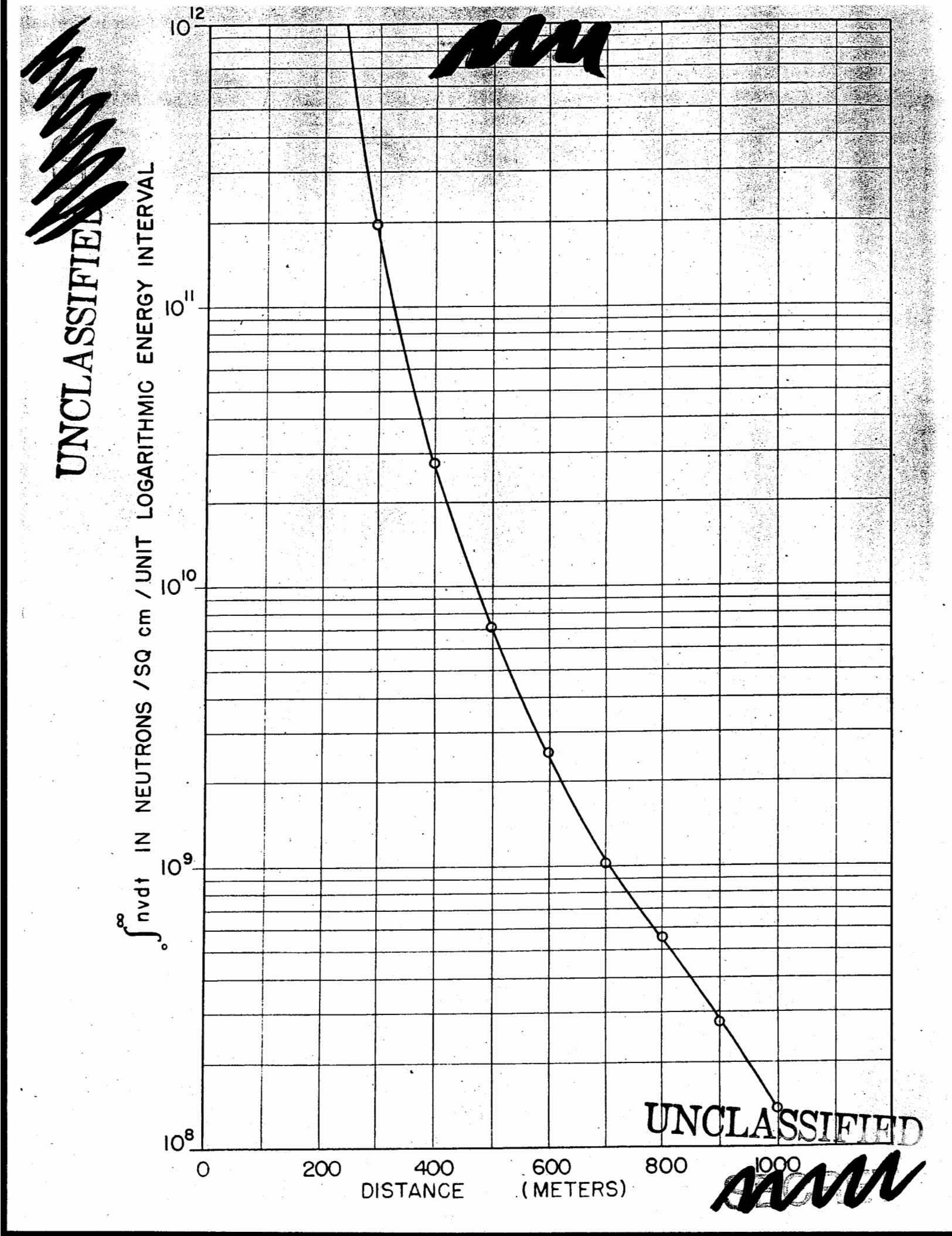
K = Thermal diffusivity (cm^2/sec)

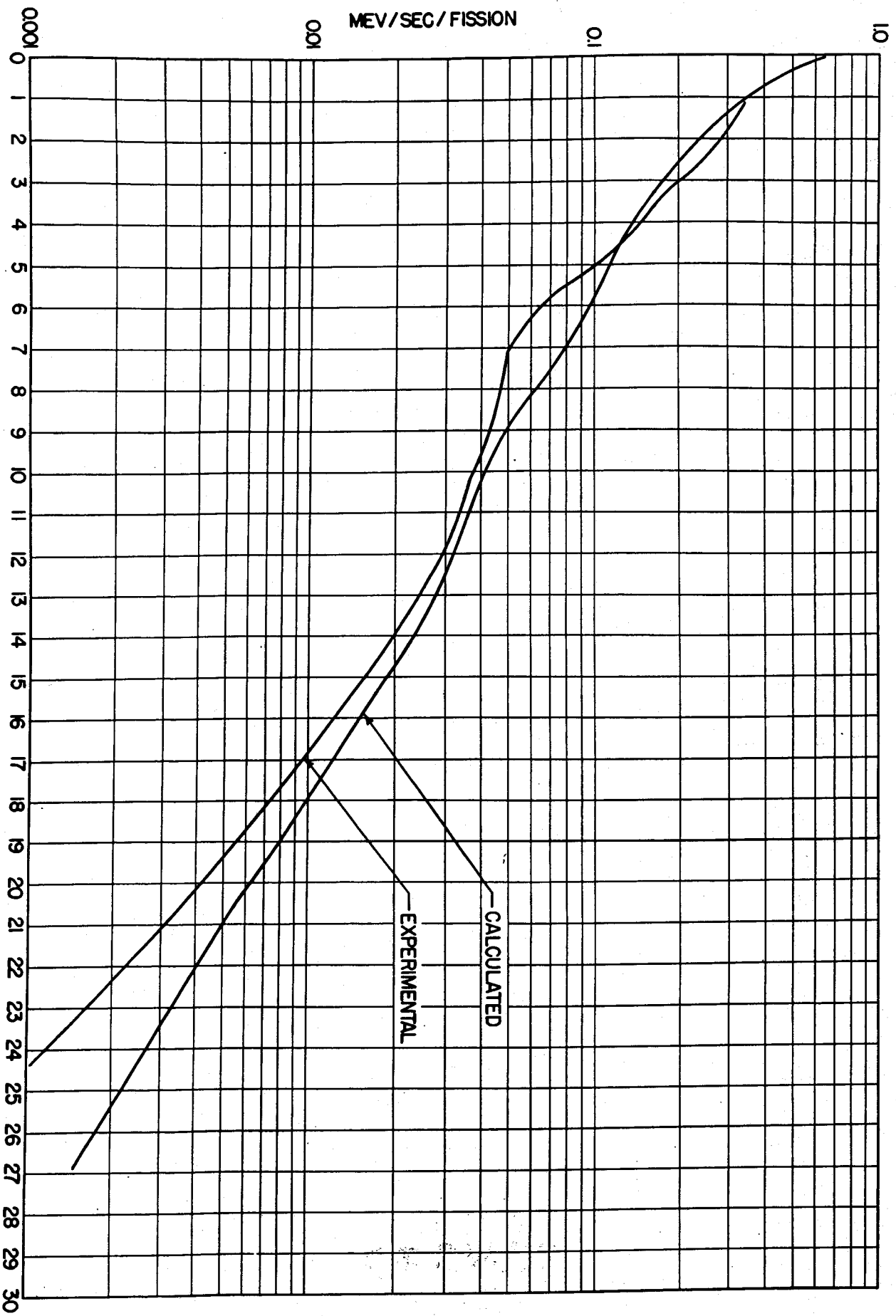
ρ = Density (g/cm^3)

C = Specific heat (cal/g degree)

The above formula shows that the source strength comes in directly whereas the time is a square root. It is thus relatively better to have an intense




UNCLASSIFIED
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
$\int_0^\infty nvdt$ IN NEUTRONS / SQ cm / UNIT LOGARITHMIC ENERGY INTERVAL
0
200
400
600
800
1000
DISTANCE (METERS)
UNCLASSIFIED



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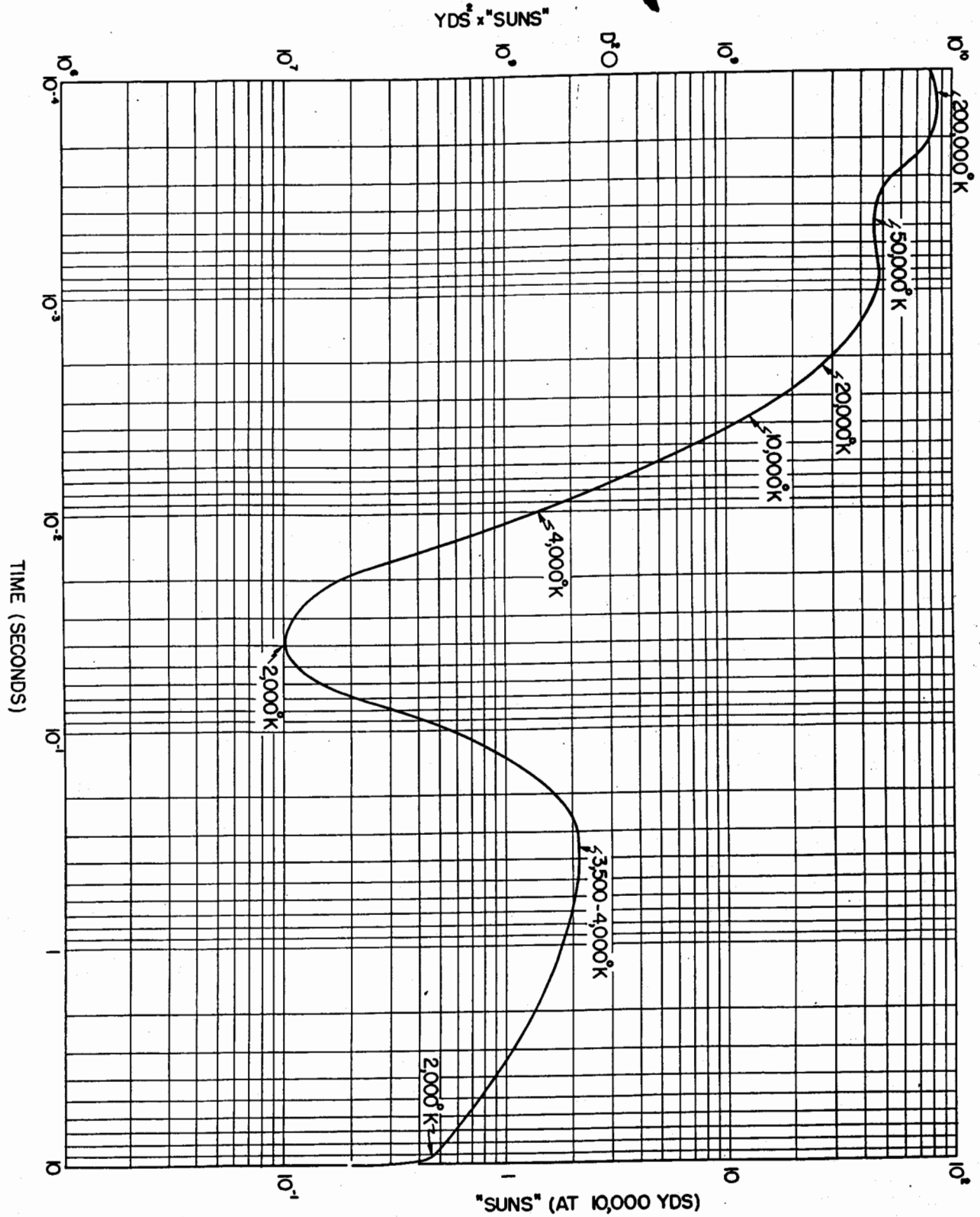
YDS² x "SUNS"
10⁶
10⁷
10⁸
10⁹
10¹⁰
10⁻⁴
10⁻³
10⁻²
10⁻¹
1
10
200,000°K
50,000°K
20,000°K
10,000°K
4,000°K
2,000°K
3,500-4,000°K
2,000°K
TIME (SECONDS)
10⁻¹
1
10
10²
"SUNS" (AT 10,000 YDS)

CHAPTER 10

SUMMARY OF TRINITY EXPERIMENTS

JULY 16, 1945 FISSION BOMB

MAY 7, 1945 100 TON

INDEX OF REPORTS

Measurements	In Charge	Equipment or Method
I. IMPLOSION		
1. Detonator Asimultaneity	K. Greisen E. W. Titterton	Detonation wave operated switches and fast scopes
2. Shock wave transmission time	D. Froman H. Sutton	Interval from firing of detonators to nuclear explosion recorded on fast scope
3. Multiplication factor (α)	a/R. R. WILSON	Electron multiplier chambers and time expander
	b/R. R. WILSON	Two chamber method
	c/B. Rossi	Single coaxial chamber, coaxial transformers and direct deflection high speed oscillograph
II. ENERGY RELEASE by Nuclear Measurements	R. R. WILSON	
1. Delayed gamma rays	E. Segre	Ionization chambers, multiple amplifiers, Heiland recorders, ground and balloon sites
2. Delayed neutrons	H. T. Richards a/	Cellophane catcher and 25 plates, on ground and airborne
	b/	Gold foil detectors to give integrated flux
	c/	Sulphur threshold detectors - 8 units
3. Conversion of Pu to fission products	a/H. L. Anderson	Determination of ratio of fission products to Pu
	b/D. Frisch J. M. HUBBARD	Collection of fission products and Pu or 25 on filters from planes at high altitude

Results	Report	Ser. No. of Rpt.	Used in 100T	In Charge	Report	Ser. No. of Rpt.
Records fogged by gamma rays	LA-437	26	-	-	-	
[redacted] DOE b(3)						
	LA-432	31	Equip. Test	M. Blair	Informal	59
Record obtained from 600 m station. Energy release consistent with H. Anderson figure	LA-367	32	-	-	-	-
No. of neutrons per cm^2 per unit logarithmic energy interval was measured for 7 stations, 300-1000 meters	LA-362	33	-	-	-	-
Two of 8 units recovered. Give n flux for energies 3 Mev at 200 m	LA-361	34	-	-	-	-
17.4 + 0.3% efficiency = 18,600 tons TNT	LA-356	35	Tracer Test	Anderson Sugarman	LA-282 LA-282A LA-290	60 60A 61
No results from TR shot dust after it circled world. Indications from Hiroshima. Nothing from Nagasaki	LA-418 also Bainbridge Russo Hubbard rpts. & LAMS-277	36A 36B 36C 36D 56	-	-	-	-

Results	Report	Ser. No. of Rpt.	Used in 100T	In Charge	Report	Ser. No. of Rpt.
				100 TON SHOT		
General blast considerations	LA-316	13	Yes	W. D. Kennedy	LAMS-247	12
No records. Traces thrown off scale by radiation effects.	LA-366	37	Yes	Walker	LA-286	62
No TR records. Shot had to be fired when planes out of position. 100 ton records and combat records			Yes	Waldman	Report to Parsons	63
Obtained velocity of sound for a small charge and then excess velocity for bomb. Yield 10,000 T	LA-352	38	Yes	Barschall	LA-291	64
			Yes	Not armed		
			-	-	-	-
Blast pressure values low compared to all other methods	LA-350	39	-	-	-	-
	LA-350 above		-	-	-	-
Highest pressure range	LA-431	40	-	-	-	-
9900 ± 1000 ton TNT equivalent	LA-354	41	Yes	Hoogterp	LA-288	65
Consistent with 10,000 tons	LA-360	42	-	-	-	-
Consistent with 10,000 tons	LA-355	43	Yes	Jorgensen	LA-284	66

Results	Report	Ser. No. of Rpt.	Used in 100T	In Charge	Report	Ser. No. of Rpt.
			-	-	-	-
19,000 tons total yield			-	-	-	-
Extrapolation from small charge and 100 T data gives 7000 tons	LA-351	44	Yes	Houghton	LA-287	67
Approximately 15,000 tons	LA-438	45	-	L.D. Leet prognosis	LA-439	68
10,000 ± 5000 tons	LA-365 LA-365A	46 46A	Yes	Penney	LA-283 LA-292	69 70
No effect at these distances	None	-	Yes	See Leet report	LA-439	68
Risk of fire produced by radiant energy is small	LA-364	47	-	-	-	-
(General prospectus)	LAMS-165 LA- 531	48 49				
Two plots of cloud obtained. Radar reflection not favorable.	Weisskopf-Purcell report	50	-	-	-	-

TRINITY EXPERIMENTS

Measurements	In Charge	Equipment or Method
IV. GENERAL PHENOMENA (cont.)		
2. Rise of Column	J.E.MACK a/	Four 100 frames/sec Mitchells One 24 frames/sec 16 mm
	b/	Two pinhole cameras
and Ball of Fire	c/F.B.Moon	Two gamma ray cameras
3. Mushrooming and lateral movement	J.E.MACK a/	Two Fairchild 9x9" aero view cameras at N-10,000 and W-10,000
	b/	Two Fairchild cameras 20 miles NE for stereo-photos
	c/	Two Fairchild cameras 20 miles E for stereo-photos
and Rise of Column	d/Capt. M.Allen	Day or night position plotting by searchlight equipment
4. Blast Cloud Effects	F.Reines analysis	J.E.Mack photos J.Aeby photos
RADIATION CHARACTERISTICS		
1. Spectrographic	J.E.MACK a/	Two Hilger high-time resolution 10^{-5} sec spectrographs
	b/	Two Bausch & Lomb 10^{-} sec spectrographs
2. Total Radiation	D.Williams J.E.MACK	Two thermocouples and recording equipment
3. Photometric	J.E.MACK a/	Two units - moving film and filters
	b/	Six photocells and filters recording on drum oscillograph

Results	Report	Ser. No. of Rpt.	Used in 100T	In Charge	Report	Ser. No. of Rpt.
These units were extremely valuable in giving the distribution of radioactive products immediately after the shot until safe stable conditions were assured			Yes	Moon	Trial for blast effects only	-
About 4 hours after shot ionization data from these chambers was radioed back to the control shelter			Yes	Anderson Hempelmann	Trial of tanks & rockets	-
Local TR ionization and at remote points to 200 miles was measured for dust-deposited fission products	LAMS-277	56	-	-	-	-
See II-3-b above	LA-418 Bainbridge Hubbard reports	36A 36B 36D	-	-	-	-
After 4 weeks, approx. 15 R/hr at edge of scoured crater, 0.02 R/hr at 500 yards	LA-359	57	Yes	Anderson	LA-282 LA-282A LA-290	60 60A 61
See complete report. Weather data obtained up to 45 minutes prior to shot at Point 0 to 20,000 ft. and 25 minutes after shot. Low level smoke studies made in event of a fizzle.	LA-357	58	Yes	Hubbard	LA-285	71